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TITLE: ARMATURE STOPPING MECHANISM FOR IMPACT PRINTER
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ABSTRACT:

PURPOSE: To speed up printing by reducing rebound of an armature impacting against a back stopper so as to quickly stabilize the armature and shortening a drive cycle.

CONSTITUTION: A back stopper 1 which receives impact of an armature 11 is made of a thin plate material. Between the stopper 1 and a substrate 2 which supports the outer periphery of the stopper 1 from the backside, a small gap 3 is provided. The gap 3 is made to be out of contact with the substrate 2 to be caused by displacement of the stopper when it receives the impact of the armature 11. A mass of the armature 11 at an impact point 11 a and a mass of the back stopper 1 at a point to be impacted are made to be almost equal to each other and energy is reduced after kinetic energy of the armature 11 before the impact is once transferred to kinetic energy of the back stopper 1. Accordingly, the armature 11 is stabilized quickly after the impact, so that influence to be given to the next driving will be reduced and a drive cycle can be shortened, thereby speeding up printing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the armature halt mechanism inside a print head in more detail about the print head of an impact printer.
[0002]
[Description of the Prior Art] As a function required of the armature halt mechanism of an impact printer, it is raised that a shock absorption is good, that it is low noise, and that it is durable. Since this invention has the feature in that a shock absorption is good and it being low noise in it, the meaning to compare explains the conventional technology in the two above-mentioned points.
[0003] Operation of an armature and the duty of the back topper in an armature halt mechanism are explained first. Drawing 18 is the fragmentary sectional view showing the relation of the back topper and the armature in the 1st example of the conventional armature halt mechanism. The armature 11 is pushed in the direction of a field of metal plate 31a of the shape of a thin ring which is the component part of the back topper 31 by the energization force of the return spring 16. Therefore, colliding point 11a of an armature contacts metal plate 31a, and the armature is made to stand by by the position. In this standby state, if it energizes in a coil 17, the generated magnetic flux will penetrate the loop from an iron core 12 to [through a yoke 13] an iron core 12 through an armature 11. As a result, pole-face 12a attracts an armature 11. And if the suction force returns and the energization force of a spring 16 is exceeded, an armature will start rotation focusing on the rotation supporting point 14 with the printing needle 15. If a suction force becomes still larger, it will be accelerated, and an armature 11 will acquire predetermined energy, and, finally will be adsorbed by pole-face 12a. However, in order that the nose of cam of the printing needle 15 may collide with printing paper through an ink ribbon just before pole-face 12a is adsorbed in an armature 11 in case it actually prints, the movement of an armature is regulated at the time and both do not contact.
[0004] Since the time of return becomes late if the aforementioned suction force remains then, the resistance welding time of a coil is adjusted and it is made for the suction force to be lost by the time of the printing needle 15 colliding with printing paper, although the movement of the armature 11 after printing will return with counteraction of a collision of the aforementioned printing needle 15 and it will be returned to the aforementioned standby state according to the stability of a spring 16. The return speed of the armature 11 after printing is about 65% of the speed in front of printing, and collides with the back topper 31 at the speed. The back topper 31 absorbs collision energy, press down the rebound phenomenon of an armature 11, a position in readiness is made to stabilize an armature promptly, and it is made not to affect the next drive in the case of the collision. They are operation of an armature in case the above is printing, and the duty of back topper.
[0005] However, a rebound of the armature from back topper will be produced [size] in smallness in fact. The behavior of a rebound of an armature is explained henceforth. Drawing 13 shows the behavior of a printing needle, and the amount of movement of a printing needle is taken along the vertical axis, and it has taken time along the horizontal axis. Since the printing needle is combined at the nose of cam of an armature, it can be said that the behavior of a printing needle is the behavior of an armature. If it energizes in a coil and an armature is driven, the printing needle combined with the armature will begin to move in the direction which separates from back (position of P points) topper [for a while] in time. This time delay to P points is based on time delay until it overcomes the delay of the standup of the magnetic flux over current, and the energization force of the above-mentioned return spring 16. Speed is reduced gradually, speed becomes zero in the position of R points, a printing needle being accelerated from the position of P points, colliding with printing paper in the position of Q points, and compressing printing paper, and it becomes the distance of return from it.
[0006] In the distance of the return of the printing needle from R points, it returns with the rebounding energy from the printing paper which carried out [aforementioned] compression, and by the rebounding energy of a spring 16, it is

accelerated and a printing needle returns toward back topper. S points in the backward stroke are positions where a printing needle separates from printing paper, and a printing needle will be accelerated only by the rebounding energy of a return spring after it. However, by within a time [of the distance of return], since the force of a return spring is small, if conspicuous, it is not accelerated. The time width of face W from Q points to S points is the time when the printing needle touches printing paper. The time of an armature colliding with back topper in the distance of return is T points, and three kinds of behavior of the printing needle after it is shown using Signs U, V, and X. Although what does not have the rebound phenomenon like the solid line shown with Sign U in it is made into an ideal, the rebound phenomenon as shown with Signs V and X in fact will arise. The dashed line shown with Sign V is an example with the bad rate of energy absorption of back topper, and since rebounding of the collision by T points is large, it has rebounded greatly. The rebound phenomenon is held down according to the energization force of a return spring, and returns to a back topper side. On the other hand, the two-dot chain line shown with Sign X is an example with the comparatively sufficient rate of energy absorption of back topper, and its amount of rebound phenomenon has become less than the precedent (example shown with Sign V).

[0007] The above is the behavior of the printing needle to the drive of a first time eye. To the 2nd drive, the rebound phenomenon of the armature of a first time eye affects the behavior of a printing needle. It rebounds, as the sign V of drawing 13 shows, and when an amount is large, as shown in drawing 14 , a printing needle will not carry out normal operation to the 2nd drive. Although the two-dot chain line of Sign Z has shown the normal behavior which must originally be carried out to drawing 14 , a printing needle carries out behavior as shown as a thick solid line to it. Since drive current is the same period like Ia and Ib and is passed one by one, when starting the next drive, as for an armature, standing still and standing by to the position is desirable. However, the rebound phenomenon arises from T points to which the armature collided with back topper in practice. Since a printing needle is in the position of Y points, the armature is already distant from the back topper side and it moreover has the speed of a drive and this direction when the following drive current Ib begins to flow As compared with the time of the first drive current Ia, the speed of an armature becomes larger and the tracing right hand lay of a normal printing needle also reaches the colliding point Q early in time. The position which should be printed as a result will shift and a character will lose its shape.

[0008] In the distance of the return of a printing needle, in case a printing needle leaves printing paper by S points, the force produced by the drive current which is flowing to N points which resist the rebounding energy received from printing paper, and exceed S points will decelerate the speed of the return of a printing needle, and, also in the tracing right hand lay of a normal printing needle, return will become late. Consequently, a bad influence will be done in the next drive again. The above becomes various [the behavior which appears according to the grade of the rate of energy absorption], although an example of behavior when the rate of energy absorption of back topper is bad was shown. Although there is also a cure of driving after it lengthens a drive period and the rebound phenomenon of an armature declines, when the performance of an armature halt mechanism is bad, the field which printing speed will fall and does not suit a time demand called a raise in printing speed comes out.

[0009] Since the performance of an armature halt mechanism led to stabilization of operation and improvement in the speed of printing as mentioned above, it was conventionally coped with with the following structures. In the armature halt mechanism shown in drawing 18 as the example, the back topper 31 piles up thin ring-like metal plate 31a same with ring-like rubber board 31b, and is constituted. The order of superposition arranges rubber board 31b for metal plate 31a after that to an armature side, and the substrate 2 which forms the back lid of a print head is supporting the whole. Metal plate 31a prevents wear of rubber board 31b by the collision of an armature, and rubber board 31b is carrying out the duty of a damper. Colliding point 11a formed near the nose of cam of an armature 11 contacts metal plate 31a, and position **** of an armature is carried out by the thickness of the back topper 31, and the physical relationship of a substrate 2. When an armature collides with metal plate 31a, metal plate 31a is made to transform rubber board 31b which deforms and exists after that. As a result, a part of collision energy is changed into heat by the internal loss of rubber, and the rebound of an armature is lessened.

[0010] The back topper in the 2nd of the other conventional armature halt mechanisms, the 3rd, and 4th examples is explained with reference to drawing 19 , drawing 20 , and drawing 21 , respectively. It is the fragmentary sectional view in which all show the composition of back topper. The arrow to illustrate shows the collision direction of an armature. That to which drawing 19 piled up the rubber board 20 on the substrate 2, and piled up polyester film 21a and 21b on it is shown. Polyester film 21a and 21b prevents wear of the rubber board 20 by the collision of an armature, and the rubber board 20 is carrying out the duty of a damper. It is the thing of composition of that drawing 20 piled up sponge 22 on the substrate 2, and piled up the plastic sheet 23 on it. Both may have been combined, when drawing 21 piled up sheet metal 24a, 24b, and 24c on the substrate 2 and the quality-of-the-material composition also had the case of only plastics only as for the metal. Absorption of the collision energy in this composition is based on vibration of each sheet metal and the viscous drag of the air inserted into each other contact interface. The above is the example of the conventional armature halt mechanism.

[0011] When the collision sound of the armature which hits the aforementioned back topper uses rubber for a damper portion, the generating sound in respect of a collision decreases considerably. However, since vibration gets across to a substrate 2 as the transmissibility of the vibrational energy inside rubber shows drawing 18 , since it is large as compared with air, the radiation area of sound becomes large and will emit a louder noise. Although the measures which generally enlarge mass of a substrate 2 and press down vibration are taken, there is a fault to which the whole head becomes heavy. Although the example shown in drawing 20 is what used sponge 22 for the damper and the transmissibility of vibrational energy can be made a little small, since the absorption coefficient of collision energy falls, there is a fault to which a rebound of an armature becomes large. Since sheet metal contacts to the collision of an armature and direct vibration transmits to a substrate 2 in the example shown in drawing 21 , to noise, it is not desirable.

[0012] As mentioned above, although the conventional armature halt mechanism had satisfied the performance to a certain demand level, it was not enough to the higher demand. The need of it being necessary to raise the damper performance of back topper more and, and also coping with the demand of the reduction in noise in office in the trend to which high printing speed-ization progresses is coming out.

[0013]

[Problem(s) to be Solved by the Invention] The rebound of an armature which collided with the back topper of an armature halt mechanism in the print head of an impact printer is made to stand it still promptly, and it sets it as the purpose of this invention to shorten a drive period and to enlarge printing speed, and is making to improve the absorption coefficient of the collision energy of back topper as the cure into the main technical problems. Reduction of the noise which doubles and makes back topper a generation source is also made into the technical problem.

[0014]

[Means for Solving the Problem] If it says that the energy will be attenuated and the reduced mass in both colliding point is doubled once it moves and changes the kinetic energy of an armature into the kinetic energy of back topper as a design for a means, it is based on the principle that a rebound of the collision of an armature becomes the minimum. And it is going to press down vibration of a back stopper in the predetermined range so that the armature which once stood it still by this principle may not carry out a variation rate and acceleration in response to the shock of the return of a back stopper further waiting.

[0015] In order to realize this design, this invention is characterized by the following composition.

(1) To illustrate to drawing 1 or drawing 5 , the periphery portion of the back topper 1 which receives the collision of an armature 11 is supported by the substrate 2 which is back, and it has the structure of coming to set the colliding point of an armature and back topper to the inside which is separated from the aforementioned periphery section, and constitute so that both conversion mass approximates in a colliding point.

(2) Prepare the crevice between the grades which do not displace and contact when back topper receives the collision of an armature between the aforementioned substrate and back topper so that it may illustrate to drawing 1 or drawing 5 , and it is a bird clapper.

Furthermore, this invention can take the following composition.

(3) Constitute the back topper 1 by the energy-absorption member allotted metal plate 1a received directly and back [its] in the shock of an armature to illustrate to drawing 5 .

(4) Prepare limiter 5a which approaches the front face of back topper and regulates vibration of a back stopper so that it may illustrate to drawing 5 or drawing 6 , and it is a bird clapper.

[0016]

[Function] According to this invention, it is necessary to move and change into the kinetic energy of back topper first the kinetic energy which an armature has. Drawing 7 explains the principle at that time. As shown in sign I, when there are the bodies A and B with the same mass and A body of speed v collides with stationary B body (state shown by sign RO), it is at the collision time, and if A body stands it still and does not have loss, B body will have the momentum of the same speed v as the aforementioned A body, as sign HA shows. What is necessary is to consider A body to be an armature and just to consider B body to be back topper in the above energy transfer. The feature of this principle is to be able to lose most rebounds of A body in a collision time, and able to stand it still in an instant.

[0017] The operation at the time of applying to the example of the structure illustrated to drawing 1 of the above principle is explained with reference to drawing 8 and drawing 9 . As shown in the fragmentary sectional view shown in drawing 9 , supposing the armature 11 of mass m collides with the back topper 1 at speed v, the periphery of a collision point starts a variation rate and the state in a collision point has kinetic energy. Although the slash has shown the range which started the variation rate, it constitutes so that it may become equal to the mass m of an armature about the equivalent reduced mass M of the range influenced [the].

[0018] The operation at the time of applying to the example of the structure illustrated to drawing 5 of the same principle is explained with reference to drawing 10 and drawing 11 . the fragmentary sectional view showing the state

in a collision point in drawing 11 supposing the armature 11 of mass m collides with metal plate 1a of the back topper 1 at speed v -- like -- the periphery of a collision point -- setting -- metal plate 1a and energy absorption -- a Members [1d and 1f] part starts a variation rate, and has kinetic energy Although the slash has shown the range which started the variation rate, it constitutes so that it may become equal to the mass m of an armature about the equivalent reduced mass M of the range influenced [the].

[0019] The portion which starts a variation rate in the case of the shock of the above [becoming a problem here] is that spread, so that the equivalent spring constant of the back stopper in an impact point serves as size, and the equivalent reduced mass M increases. This principle is explained using drawing 12 . The body B which it mass m Comes to set to this drawing, and the body C which becomes mass m1 are combined through Spring k. While there is a body A of the same mass as B as shown in sign I, and B body and C body are standing it still When the spring constant of Spring k which considers the case (state shown by sign RO) where A body of speed v collides to B body is smallness Since the same behavior as the case where B body hardly receives the force from a spring, but there is no spring is shown, it is at the collision time, and if A body stands it still and does not have loss, B body will have the same speed v as the aforementioned A body, as sign HA shows. On the other hand, there is no C body in ** and ********. Therefore, it can be considered in this case that an equivalent reduced mass is m. B body and C body come to exercise as one as the spring constant of Spring k serves as size, and an equivalent reduced mass becomes m+m1 closely. m1 -- m -- comparing -- size -- a case -- after a collision -- sign HA -- being shown -- as -- B body and C body -- almost -- not moving -- reverse -- A body -- rebounding -- the collision speed v -- some -- smallness -- it is speed v1 and exercises for opposite direction the equivalent spring of the back topper in an impact point when an armature, B body, and Spring k are considered to be back stoppers and C body is considered to be a substrate for A body, in order to make an armature stand it still at the time of a collision -- a constant -- **** -- it is required to press down low and to inhibit the increase in equivalent transformation mass In this invention, the spring constant of a back stopper is low pressed down by whether it is made further between a back stopper and a substrate, and supporting the periphery of back strike topper by the substrate, as shown in drawing 1 and drawing 5 , establishing an impact point in the inside which is distant from the circumference, and preparing a crevice.

[0020] Next, it is necessary to brake movement of a back stopper quickly. This is because the shock which is not desirable is added to the armature which sets the line of vibration of return, passes an equilibrium point, vibrates to an opposite direction further, and is standing by at the point if it does not brake at all, since initial velocity can be suddenly given from an equilibrium point and vibration is started. Although the elasticity of a back stopper restores the slash portion M which caused deformation momentarily by the shock of an armature as this invention was shown in drawing 9 or drawing 11 , it is transmitted all over a back stopper as wave motion and it goes, when it is multi-pin printing, a variation rate is especially large the first stage, and braking of vibration is indispensable. Below, lessons is taken from an operation of braking in this invention, and it states.

(1) When back topper receives the collision of an armature between the aforementioned substrate and back topper, decrease vibration of the back topper 1 by the viscous drag of the air of the portion of a crevice 3 according to the structure of coming to prepare the crevice between the grades which do not displace and contact. This operation is carried out to reference and drawing 8 and drawing 9 are described in more detail. Although it is transmitted all over back topper as wave motion and goes since the elastic energy of the back topper 1 restores the slash portion M which started the variation rate momentarily by the collision of an armature 11 as shown in drawing 9 , as shown in drawing 8 , vibration of the back topper 1 is decreased by the viscous drag of the air of the portion of a crevice 3. Moreover, the periphery of the back topper 1 touches the substrate 2, as Sign K shows, and since the thickness of the air space of this contact portion is sufficiently thinner than the aforementioned crevice 3, a damping effect becomes large. Moreover, since touch with the 2nd page of a substrate will be lost somewhat and it will contact only in the maximum position of the amplitude of the back topper 1 when, as for the contact portion shown with Sign K, the back topper 1 begins vibration, the ratio from which vibration of the back topper 1 is transmitted to a base 2 falls, and noise decreases.

(2) constituting the back topper 1 by the energy-absorption member allotted metal plate 1a received directly and back [its] in the shock of an armature, as shown in drawing 5 -- the energy of vibration of back topper -- energy absorption -- braking of back topper can be further strengthened by absorbing by the internal loss accompanying deformation of a member

(3) By preparing limiter 5a which approaches the front face of a back stopper and regulates vibration of a back stopper as shown in drawing 5 , brake movement of back topper quickly and prevent the re-collision to an armature as much as possible.

[0021]

[Example]

(Example 1) The 1st example of this invention is explained with reference to a drawing below. Drawing 1 is the fragmentary sectional view of an armature halt mechanism, and in order to show the relation between the back topper 1

and an armature 11, the drive magnetic circuit of an armature is also shown in drawing 1 . Sign C showed the center of a head, although it was not carrying out illustration, it has arranged two or more aforementioned drive magnetic circuits around it at the radial, and it has turned to the nose of cam of each armature 11 in the direction of the center shown with Sign C. Since it is the same as the content explained based on drawing 12 in the Prior art, a drive and operation of an armature are omitted. The armature 11 is energized in the back topper 1 direction with the return spring 16, and colliding point 11a of an armature is standing by to the position in contact with the field of the back topper 1.

[0022] The back topper 1 which receives the collision of an armature 11 is constituted from a thin plate. While making it the grade which displaces when few crevices 3 are formed between the substrates 2 which support the periphery portion of this back topper 1 from behind and, as for the crevice 3, the back topper 1 receives the collision of an armature 11, and does not contact a substrate 2 It constitutes so that it may become in general equal about the mass in colliding point 11a of an armature, and the mass in the point of the back topper 1 colliding [-ed]. Although it is mostly set as the midpoint, the thing of the center C of a crevice 3 and Periphery D which were formed circularly superficially restricted to this position not necessarily does not have a collision position to the back topper 1 of an armature 11. If a collision position approaches the periphery D of a crevice 3 too much, since the influence of the substrate 2 which is in contact with the 1st page of back topper will come out, it is not desirable.

[0023] As shown in the plan of drawing 2 , the back topper 1 prepares bond-part 1b in the periphery of the back topper 1, and it joins to a substrate 2 and it supports only the part of joint 1c of the bond-part 1b. For this reason, from the 2nd page of a substrate, the back topper 1 can have come floating somewhat and can vibrate now. In addition, although it is equivalent to the portion which the back topper 1 and the substrate 2 touch between the dashed line shown in this drawing, and the periphery of the back topper 1, since the thickness of the air space of this portion is very thin, the back topper 1 by the viscous drag of air vibrates. It comes out, and since it is, as long as a design allows, taking greatly is desirable [the area of the portion which the back topper 1 and the substrate 2 touch].

[0024] Thickness constitutes it from a 0.15 to about 0.3mm thin circular metal plate, the back topper 1 prepares bond-part 1c in the particular part of a periphery, as shown in the plan shown in drawing 2 , and it joins to a substrate 2 and it supports joint 1c of bond-part 1b. Since pliability is somewhat given to the portion of bond-part 1b, the back topper 1 can have lost somewhat touch with on the 2nd page of a substrate, and can vibrate.

[0025] Mass doubling of the back topper 1 and the armature 11 which are shown in drawing 1 is performed by selecting the thickness of the back topper 1. When a crevice 3 is formed behind the back topper 1 between substrates 2 and an armature 11 collides with the back topper 1, the back topper 1 displaces and it prevents from having touched the substrate 2. A crevice 3 is set to about 0.2mm from 0.05mm. The superficial configuration of a crevice 3 is circular, the center is made in agreement with the center of a head, and the diameter is set to about 25mm. If it is desirable that it is an air space as for this crevice 3, for example, liquids, such as an oil, are put in, the damper performance to a collision will fall on the contrary.

[0026] The damper effect of the back topper 1 in drawing 1 is as follows. If colliding point 11a of an armature 11 collides with the back topper 1, since the mass of both in a colliding point is put together, the kinetic energy of an armature 11 is transformed into the partial displacement energy of the back topper 1, and an armature 11 stands it still in an instant. Most rebound phenomenon of an armature 11 is not produced at this time. henceforth, the viscous drag of the air of the crevice 3 formed behind the back topper 1 in the process which the partial variation rate of the aforementioned back topper 1 restores while the energy carried out oscillating diffusion in the direction of a field -- it is absorbed Although the rebound phenomenon of an armature arises somewhat by vibration produced in the process which the variation rate of this back topper 1 restores, as compared with the conventional back topper, it has decreased very much.

[0027] (Example 2) the method of supporting the periphery of the back topper 1 other than the above-mentioned [the manner of support of the back topper 1] by the flat spring 4, as shown in drawing 3 as the 2nd example -- or although not illustrated, only the periphery section can also be similarly ******(ed) with sponge etc. If it is necessary to consider support of the back topper 1 for example, so that it can vibrate to a substrate 2 as freely as possible, and the periphery of the back topper 1 is fixed to a substrate 2, a damper performance will get worse.

[0028] (Example 3) Although the example for which the above constituted back topper from a thin metal plate of one sheet was explained, as shown in drawing 4 as the 3rd example, a two-sheet pile is sufficient as the back topper 1 in metal plate 1a. In this case, since the air space between the 2nd sheet indicates the damper effect to be the 1st sheet, a performance improves further. Each resonant frequencies differ [the direction changed, respectively], and the damping effect of thickness of the metal plate of two sheets of vibration improves. Moreover, the direction of rebound phenomenon of an armature which thickened the metal plate by the side of an armature decreases.

[0029] (Example 4) Drawing 5 is the fragmentary sectional view of the 4th example of the armature halt mechanism of this invention, and in order to show the relation between the back topper 1 and an armature 11, the magnetic circuit for a drive of an armature is also shown in drawing 5 . Sign C showed the center of a head, although it had not carried out

illustration, it has arranged two or more aforementioned magnetic circuits for a drive around it at the radial, and it has turned to the nose of cam of each armature 11 in the direction of the nose of cam shown with Sign C. Since it is the same as the content explained based on drawing 18 in the Prior art, a drive and operation of an armature are omitted. The armature 11 is energized in the direction of the back topper 1 with the return spring 16, and is standing by to the position in contact with the field of metal plate 1a of the back topper 1. The collision position to the back topper of an armature 11 may be considered to be the position where the above contacts, and is set to the inside which is separated from the periphery section by which back topper is supported.

[0030] the 2nd energy absorption which makes the disk configuration to which the back topper 1 has a hole for positioning at the center on a substrate 2 -- the 1st energy absorption of 1f of members, and the same configuration -- metal plate 1a of 1d of members and the same configuration is piled up one by one, and positioning is carried out by the gage pin 5 which **** in the hole for the aforementioned positioning and is attached in a substrate 2 Head 5a of a gage pin 5 counters the front face of metal plate 1a with few crevices, and acts as a limiter which suppresses vibration of back topper. the 2nd aforementioned energy absorption -- 1f of members is supported by 2nd supporter 2b which projects the shape of a ring prepared in the substrate 2 corresponding to the 1st supporter 2a prepared in the substrate 2 corresponding to the periphery section, and the collision position of an armature Thus, since this example performs positioning of back topper and a limit of vibration by one pin, it becomes easy [structure].

[0031] It is thin by about 26mm from 0.25mm, and, as for the above-mentioned metal plate 1a, a diameter consists of stainless steel. the 1st energy absorption -- 1d of members is 1mm in thickness, and they consist of a fluororubber of a degree of hardness 50 the 2nd energy absorption -- 1f of members is the silicone rubber of a degree of hardness 50 in 1mm in thickness The crevice between head 5a of a gage pin and metal plate 1a is about 0.08mm. The 1st supporter for back stopper support formed in the substrate 2 is the salient of the shape of a ring with a width of face of 0.5mm for the diameter of 25mm, and, similarly the 2nd supporter is a ring-like salient with a width of face of 1mm for the diameter of 9mm. thus, the energy absorption [formed / the 2nd supporter corresponding to the collision position of an armature] at the time of a collision -- it is for deforming a member effectively and gathering the absorption efficiency of vibrational energy Moreover, although it has the limiter (head 5a of a gage pin) of oscillating suppression in a core because an effect is most to press down the rebound phenomenon of metal plate 1a, an appropriate effect is acquired even if it makes a limiter into the form lengthened inside a periphery shell. When using a rubber board behind metal plate 1a as an energy-absorption member, it is checked experimentally that the way of the performance of periodic damping which combined the thing of the quality of the material from which a property differs rather than single quality-of-the-material composition improves.

[0032] Mass doubling of the back topper 1 shown in drawing 5 and an armature 11 is performed by mainly selecting the thickness of metal plate 1a. Drawing 5 The damper effect of the shown back topper 1 is as follows. If colliding point 11a of an armature 11 collides with metal plate 1a of the back topper 1, since the mass of both of the mass (mass corresponding to the slash section of drawing 11) of the back topper synthesizing the mass, metal plate, and energy-absorption member of an armature in a colliding point is put together, the kinetic energy of an armature 11 is transformed into the partial displacement energy of the back topper 1, and an armature 11 stands it still in an instant. Most rebounds of an armature 11 are not produced at this time. henceforth, the viscous drag of the air of the crevice 3 formed behind the back topper 1 in the process which the partial variation rate of the aforementioned back topper 1 restores while the energy carried out oscillating diffusion in the direction of a field -- the energy absorption with which it was absorbed and which was further matched with the energy behind metal plate 1a -- it is absorbed by the internal loss accompanying deformation of a member, and the shock of the return to an armature is suppressed by the aforementioned limiter

[0033] (Example 5) Not only in the above-mentioned case, application of the limiter in this invention As shown in drawing 6 as the 5th example, the metal plate of one sheet is used as back topper 1. The periphery portion of this metal plate can be supported by the substrate 2, a crevice 3 can be formed between a metal plate and a substrate 2, a metal plate can be positioned by the gage pin 5, it can approach on the surface of a metal plate, and the structure of coming to prepare limiter 5a which is a part of gage pin can be taken. In this case, about braking to back topper, it is suppressed by the limiter like the above-mentioned other than the viscous drag of air.

[0034]

[Effect of the Invention] The survey result of the behavior of the printing needle when applying the back topper in the 1st example of this invention and the 4th example to drawing 15 and drawing 16 , respectively is shown, and the movement of a printing needle is taken along the vertical axis, and it has taken time along the horizontal axis. Although Sign T has shown the time of an armature returning in it and colliding with back topper, till the time of Sign F showing after it, there is almost no rebound, in any case, behavior is stable in an instant, and it is in the state almost near an ideal. By doubling the mass in the colliding point of an armature, and the mass in the point of back topper colliding [-ed], such a state shows that the kinetic energy which an armature has was completely transformed into the

displacement energy of back topper, and shows the property which is not acquired with the composition with which collision energy is absorbed by the internal loss of back topper like before. A slight rebound of the armature after Sign F is based on the influence of vibration which cannot decrease back topper, and its rebound has become less than the case of the 1st example which the direction in the case of the 4th example shown in drawing 16 shows to drawing 15 further. However, since there are few the amounts, neither of the cases almost affects the behavior of an armature. Since the illustrated survey result still is not measurement under optimum conditions, the room of improvement of the aforementioned damping property is fully left behind.

[0035] Drawing 17 applies the technology of the 4th example of this invention, and is as a result of [of the behavior of the printing needle when carrying out a continuation drive] survey. Although only the wave in early stages of a drive is shown, this wave continues henceforth. Sign Ia shows periodic drive current and the period has become 0.45ms. The result of this drawing does not almost have the influence of a rebound of the armature from back topper, and it is shown that the armature has followed and answered normally to drive current. Since the influence to the next drive decreases since the rebound of an armature which collided with back topper is [behavior] promptly stable few, and a drive period contracts with the back topper of this invention as mentioned above, the improvement of improvement in the speed of printing can be performed. When the technology of other examples of this invention is applied, the almost same effect is acquired.

[0036] The reduction effect over noise is as follows. As for the noise which comes out of a print head, what is depended on vibration of the case which forms the jacket of a print head is main. Therefore, reduction of noise has started how collision vibration of the armature which is running by the interior of a head at high speed is intercepted between the aforementioned cases. Since the crevice 3 is formed behind the back topper 1 according to this invention, collision vibration of an armature will not get across to the direct substrate 2 (a jacket is formed), but when the back topper 1 vibrates, it will be transmitted through the portion in contact with the substrate 2 on the periphery. However, if the back topper 1 begins vibration, since it will come floating somewhat, as for the back topper 1, a thin air space will be formed from the 2nd page of a substrate and the 2nd page of a substrate will be contacted only in the position of the maximum [topper / back / 1 / amplitude], the transmissibility of vibrational energy will become small, vibration of a substrate 2 will decrease, and noise will fall.

[Translation done.]